SAMPLING FOR LARVAL RIO GRANDE SILVERY MINNOW
NEAR THE MOUTH OF ELEPHANT BUTTE RESERVOIR

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Annotated field notes, figures, and tables are based on provisional data that is subject to change

The 2001 Rio Grande silvery minnow egg salvage effort that began on 1 May 2001 is scheduled to continue through the end of June 2001. To date, the major reproductive effort of Rio Grande silvery minnow occurred during 9-12 May 2001 when catch rates were high and several thousand eggs were taken. Since that time, the number of eggs collected has frequently been <10/day although large quantities of water have been sampled. Based on our past research on Rio Grande silvery minnow and other species who are members of the semibuoyant egg reproductive guild, we believe it unlikely that there will be an additional spawning spike.

The sampling location selected for the egg salvage project (estimated to be 5-10 kilometers upstream of the mouth of Elephant Butte Reservoir) was chosen because it was believed that the vast majority of all eggs passing that point would be transported into the reservoir where they would perish. In addition, our 2000 population monitoring data demonstrate that over 90% of the remaining population of Rio Grande silvery minnow occur downstream of San Acacia Diversion Dam and this sampling locality would maximize our catch of their eggs.

The potential that there would be a marked concentration of larval silvery minnow in the lowest portion of the San Acacia Reach of the river prompted us to undertake a cursory fish sampling survey of the Rio Grande in this downstream reach. The goal was to ascertain if large numbers of larval Rio Grande silvery minnow were occupying this area of the river. Because of the extreme vulnerability of larval fish in this reach to being transported into Elephant Butte Reservoir under conditions of high sustained flows or being stranded and dying under low flows, it was necessary to determine their presence and abundance.

On 6 June 2001, a sampling effort that focused exclusively on locating larval Rio Grande silvery minnow in the extreme southern reach of the Middle Rio Grande was conducted. The site sampled was located about 20 miles downstream of the southern end of the Bosque del Apache National Wildlife Refuge near river mile 57. The specific location was 3713789N/0307038E, Zone 13 (Socorro Co.; Paraje Well Quad). Substrate at this site consisted primarily of sand and silt. Water temperature was relatively warm (21°C at 11:30) and several shallow backwaters were noticeably warmer than the main channel. Water level was moderate (ca. 1,200 cfs) and water clarity was low. Current velocity varied widely throughout the site from about 0.8 m/s in main channel habitats to 0 m/s in the numerous backwaters present. The site was accessed by walking about 1.6 km south of the end of the United States Bureau of Reclamation (USBR) road that parallels the Rio Grande along its western shore in this river reach.

The morphology of the river changes rapidly downstream of the end of the USBR road. The river becomes wider, shallow, and more braided than that observed upstream. This is primarily due to the failure of an extensive levee mound that extends downstream from the end of the USBR road. The road acts as a levee up to the point were it is terminated. It is apparent that moderately high water levels would eliminate the final 0.5 km of the road and it is not maintained within this final stretch.

The levee achieves a height of several meters above the level of the river (at 1,200 cfs) but has apparently been recently breached in several areas. It is possible that recent high flows released from Cochiti Reservoir resulted in flooding flows downstream and new breach points. Areas where the river breached the levee have become extensive backwater habitats with low velocities and warm water temperatures. The effect of breaching has resulted in a much more highly braided river, the creation of a multitude of side channel habitats, and a dramatic increase in habitat heterogeneity. The effective channel width of the river progressively increased up to downstream as more points in the levee were breached. The river followed its natural course for its final few kilometers into

Elephant Butte Reservoir. Within this area the river became very wide with numerous side channels and backwaters. These conditions are unlike any that exist in the rest of the Middle Rio Grande where the river is largely confined within a highly developed system of levees and jetty jacks that inhibit it from expanding to its natural width.

Conditions in the area of this site provided for high densities of larval and juvenile fishes including Rio Grande silvery minnow *Hybognathus amarus* (Figure 1). Other species collected were red shiner *Cyprinella lutrensis*, common carp *Cyprinus carpio*, fathead minnow *Pimephales promelas*, flathead chub *Platygobio gracilis*, river carpsucker *Carpiodes carpio*, western mosquitofish *Gambusia affinis*, and walleye *Stizostedion vitreum*. Relatively few seine hauls resulted in the collection of over 250 larval and juvenile individuals.

A total of 61 Rio Grande silvery minnow was collected in five seine hauls in habitats that included one isolated pool (2 m x 1 m) and four short hauls (range=2 m to 6 m) along the shorelines of several large backwaters. More individuals could have been easily collected but the purpose of this sampling foray was to document basic ichthyofaunal community structure and abundance in this remote location, not to collect thousands of larval fish. The density of Rio Grande silvery minnow (358.8/100m^2) was nearly an order of magnitude greater than any collection made in the Middle Rio Grande in 2000. It must be noted, however, that small individuals are more numerous than larger ones and that only habitats likely to contain moderate to high numbers of individuals were sampled during this collection foray. Despite this qualification, it was impressive to collect Rio Grande silvery minnow with little effort; a feat that has proven nearly impossible in recent years in the Middle Rio Grande.

Although moderately high densities of Rio Grande silvery minnow were present, translocating them from this locality was not deemed appropriate. The remote location, wide variety and spatial distribution of habitats, and presence of multiple species make it difficult to successfully translocate these individuals. Additionally, conditions within this reach of the Rio Grande, if maintained, are currently appropriate for the growth and development of these fishes.

There were numerous species present within single seine hauls and there did not appear to be obvious habitat selection differences between taxa. All individuals were located within or immediately adjacent to areas of zero water velocity, silt substrata, and moderately warm water temperatures. Fish were dispersed throughout a wide area within the vicinity of the site but were concentrated along the shoreline of backwaters that were adjacent to shallow side channels with low water velocities.

Rio Grande silvery minnow appeared to have been deposited into deep portions of a limited number of side channels during recent high flow events. A single small isolated pool contained a modest number of very small (<10 mm SL) Rio Grande silvery minnow propagules that were likely displaced into this area during high flows and stranded as flows receded. This probably occurred only at locations where water would not naturally drain to the river following decreased discharge. Areas where sediments had been removed (anthropogenetically) from the floodplain (i.e., dredging activities or levee maintenance) could result in artificial pooling of water and stranding/loss of eggs or larval fishes.

It appeared that breached levee reaches were highly utilized by larval fishes including Rio Grande silvery minnow. Levee breaches resulted in the creation of numerous winding side channels and backwaters. Water velocities within these areas rapidly decreased as portions of the river meandered widely to the east and west and occasionally to the north. Some of these braided side channels and backwaters were several hundred meters from the main river channel.

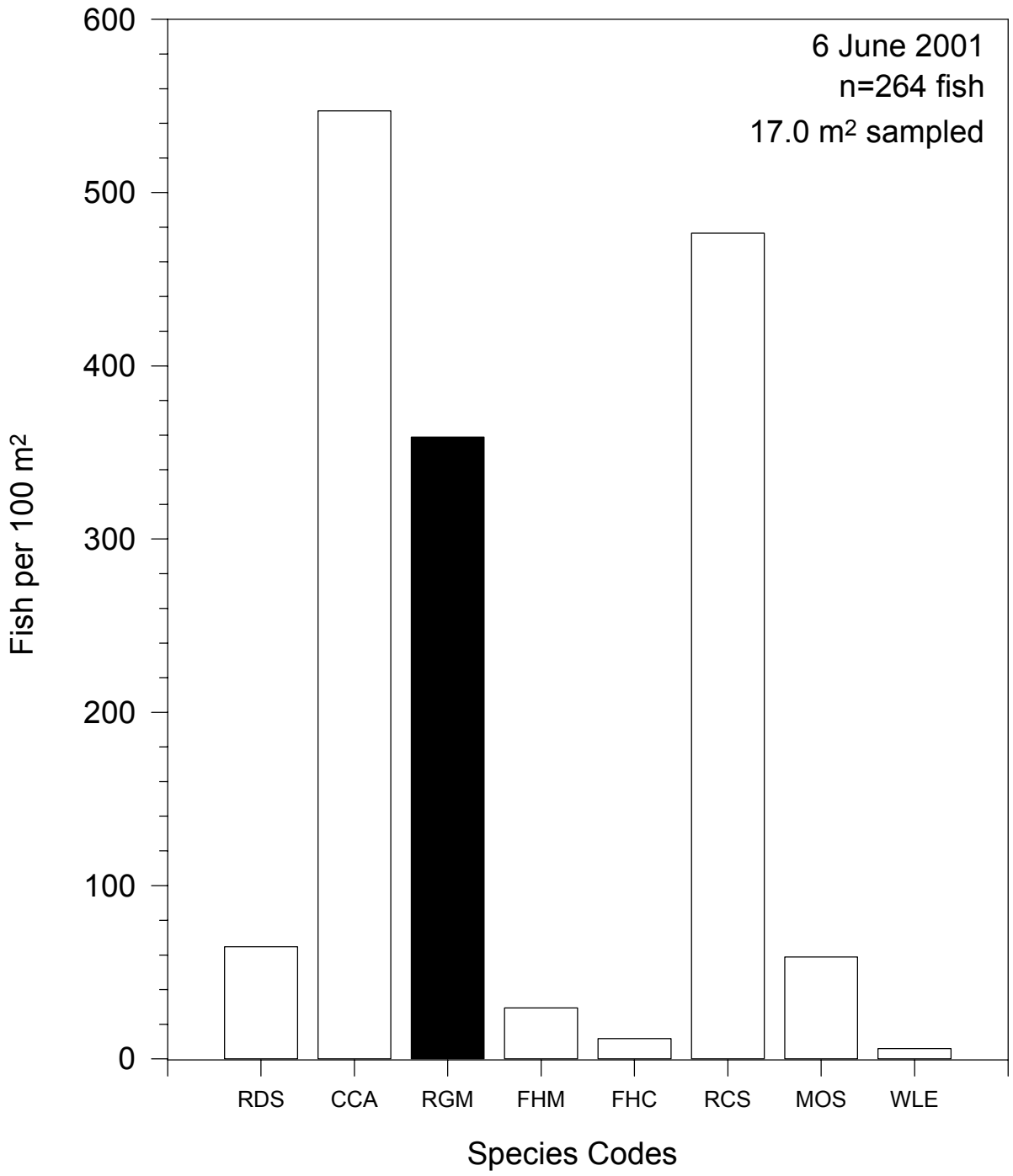

Figure 1. Fish catch rates for species (see Table 1 for species abbreviations) collected in the Middle Rio Grande on 6 June 2001. Histogram bar for Rio Grande silvery minnow (RGM) is black to highlight this species.

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Table 1. Scientific and common names and species codes of fish collected during the 6 June 2001 sampling foray.

Scientific Name	Common Name	Code
Order Cypriniformes		
Family Cyprinidae	carps and minnows	
Cyprinella lutrensis	red shiner	(RDS)
Cyprinus carpio	common carp	(CCA)
Hybognathus amarus	Rio Grande silvery minnow	(RGM)
Pimephales promelas	fathead minnow	(FHM)
Platygobio gracilis	flathead chub	(FHC)
Family Catostomidae	suckers	
Carpiodes carpio	river carpsucker	(RCS)
Order Cyprinodontiformes		
Family Poeciliidae	livebearers	
Gambusia affinis	western mosquitofish	(MOS)
Order Perciformes		
Family Percidae	perches	
Stizostedion vitreum	walleye	(WLE)

It is likely that many Rio Grande silvery minnow eggs and drifting larvae from the 2001 spawn settled in these habitats because of the greatly reduced water velocities. It is also likely that their rapid growth within one month of spawning (e.g., some individuals were 18 mm SL) was the result of favorable abiotic conditions in these expansive nursery areas. Other native fishes like river carpsucker also utilized these areas extensively.

Rio Grande silvery minnow larvae will leave these areas later in the year but it is not known what effect syntopic fishes will have on them prior to their departure. The negative effects of competition and predation could be expected to be greater on these individuals because of their close proximity to a source of introduced piscivores (i.e., Elephant Butte Reservoir). However, the abundance of Rio Grande silvery minnow within this area indicates that these pressures currently do not preclude the repopulation of upstream reaches by these individuals.

Current and future levee maintenance activities could negatively impact larval Rio Grande silvery minnow in the southern most portion of the Middle Rio Grande. If the river is bisected by the repair of areas where the levee has been breached, high numbers of Rio Grande silvery minnow could be stranded and lost. Although, the cumulative loss of Rio Grande silvery minnow eggs and larvae to Elephant Butte Reservoir for 2001 have not yet been calculated, the presence of relatively large numbers of larval individuals suggest that conditions in the final few kilometers of the Middle Rio Grande are highly beneficial to this species. Persistence of current conditions (i.e., not stranding fish or drying the river channel) may have a notably positive effect on this years cohort of Rio Grande silvery minnow within the San Acacia Reach. Repair and maintenance of the current levee system within this region could result in immediate losses of larval Rio Grande silvery minnow and will contribute to the continued displacement of Rio Grande silvery minnow eggs and larvae into Elephant Butte Reservoir during future spawning events. Future activities in this section of the Middle Rio Grande that would benefit Rio Grande silvery minnow include removing present nonessential or failed levees, abandoning current efforts to channelize the final reach of the Rio Grande into Elephant Butte Reservoir, and allowing the river to follow its natural meandering course over the greatest longitudinal distance possible.